



FAA-C-2798
August 29, 1988

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DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

SPECIFICATION

Rehabilitation Of Standard ASR-4/5 Building

To Accept ASR-7/8 Without Mode S



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TC/01

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Suggested Wording for FAA to
Incorporate into Division I on
Specification FAA-C-2798

DIVISION I - GENERAL REQUIREMENTS

1-1 SUMMARY OF WORK

1-1.1 General.- These specifications, together with the referenced specifications, standards and drawings specified in the Contract Documents, cover the requirements of the Federal Aviation Administration, hereinafter referred to as the Government or FAA, for all work associated with the rehabilitation of an existing airport surveillance radar (ASR) facility, mode ASR-4 or 5 to accept ASR-7 or 8 equipment without Mode S.

1-1.2 Scope.- The work includes rehabilitation of electrical and HVAC systems and the construction and installation of appurtenances to the foregoing as specified and indicated by the drawings or required by the FAA standard specifications which are a part of this contract.

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15-1 HEATING, VENTILATING AND AIR-CONDITIONING

15-1.1 General.-

15-1.1.1 Scope.- This section specifies heating, ventilating and air conditioning. The system consists of electric unit heaters, motorized dampers, automatic temperature control system, interconnecting wiring, and modification of existing air-conditioning unit.

15-1.2 Applicable documents.- The current issues of the following documents in effect on the date of the invitation for bid form a part of this specification and are applicable to the extent specified herein.

15-1.2.1 American Society for Testing and Materials (ASTM).-

B221 Aluminum and Aluminum Alloy Extruded Bar, Rod, Wire, Shapes and Tubes

15-1.2.2 National Fire Protection Association (NFPA).-

70 National Electrical Code (NEC).

15-1.2.3 Underwriters Laboratories (UL).-

Building Materials Directory

15-1.3 Materials.-

15-1.3.1 Motorized dampers.-

15-1.3.1.1 General.- Design dampers to close upon the failure of power. Furnish motors, switches, transformers, relays, timers, and other control devices. Dampers shall have two positions, low leakage type parallel blades designed to operate in the vertical position for horizontal air flow. Use American Warming and Ventilating, Model VC-20, or approved equal.

15-1.3.1.2 Blades.- ASTM B221, extruded aluminum alloy type 6063-T52, .074 inch thick. Furnish extruded silicone blade seals and polyurethane jamb seal.

15-1.3.1.3 Frames.- ASTM B221, extruded aluminum alloy type 6063-T52, .081 inch thick.

15-1.3.1.4 Shafts.- Extruded aluminum, 1/2-inch diameter with oilite, bronze bearings and face mounted linkage.

15-1.3.1.5 Dissimilar materials.- Separate the joints between aluminum and other metals with sheet lead, polyvinyl tape or sheet neoprene.

15-1.3.1.6 Fasteners.- Stainless steel, type 303.

15-1.3.2 Automatic temperature controls.-

15-1.3.2.1 General.- Control devices shall be 24 VAC. Relays, switches, timers, transformers and other control devices shall be mounted in the unit control panel. Watt rating of control transformers shall be minimum 1-1/2 times total watt rating of connected control devices. Transformer shall be fused on the secondary side of control circuit. The air conditioning unit and controls shall be designed for year-around continuous and automatic operation. Use Honeywell or approved equal.

15-1.3.2.2 Tolerance.- An average variation of two degrees F, plus or minus, from the set point of the thermostat setting is acceptable, subject to specified capacity limitations.

15-1.3.3 Unit heater.-

15-1.3.3.1 General.- UL listed and labeled. Heater shall be factory assembled, horizontal type, consisting of electric heating element, fan, motor, housing, outlet diffuser and controls. Use Electromode Company, Series EUH or approved equal.

15-1.3.3.2 Casing.- Minimum 18-gage, hot-dip galvanized steel, bonderized and factory finished with a baked-on enamel paint. Casing sides shall be readily removable for access and maintenance. Suspended units shall be designed for direct attachment to the hangers.

15-1.3.3.3 Vanes.- Adjustable type, horizontal and vertical vanes, nozzles or diffusers, arranged to provide uniform air distribution.

15-1.3.3.4 Heating element.- Copper-clad steel sheath with aluminum fins.

15-1.3.3.5 Motor.- Totally enclosed with built-in thermal overload protection and permanently lubricated ball bearings. Bearings shall be sealed, sleeve type.

15-1.3.3.6 Controls.- Furnish controls and safety devices including automatic thermal limit switch, fan delay switch, and built-in unit mounted thermostat.

15-1.4 Installation.-

15-1.4.1 Motorized dampers.- Install in accordance with NEC, manufacturers instructions and the approved shop drawings.

15-1.4.2 Automatic temperature controls.-

15-1.4.2.1 General.- Install in accordance with the manufacturers instructions and the following:

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15-1.4.2.1.1 Wiring and panel.-- Control wiring shall be installed in conduit, parallel to building lines and surfaces. Mount the control panel on an insulated base and attach panel to wall. Top of panel shall be 6 feet above the floor.

15-1.4.2.1.2 Thermostats.-- Mount thermostats 5 feet above the floor on an insulated base.

15-1.4.3 Unit heater.-- Install in accordance with NEC, and the manufacturers instructions. Provide supports, hangers and isolators, and anchor bolts necessary to withstand the applicable seismic force.

15-1.4.4 Existing air conditioning unit (ACU-1).--

15-1.4.4.1 Modifications.--

(a) Add new low ambient controls designed to permit operation of system down to minus 20 F. Also modify 24V control systems to permit supply fan to operate continuously and not cycle with the compressor.

(b) Disable the economizer cycle if unit is so equipped.

15-1.4.5 Filters.-- At the time of final acceptance install new filters in the air conditioning unit. Also furnish two spare filters.

15-1.5 Quality assurance.--

15-1.5.1 Operating tests - control system.-- Calibrate and test connected components to ensure the system performs in accordance with the sequence of operation shown on the drawings.

15-1.5.2 Submittals.-- Conform to the procedures specified.

15-1.5.2.1 Product data.-- Submit electric heating equipment, motorized damper and automatic temperature control catalog data. Manufacturer's catalog data shall completely describe each component and device incorporated into the equipment including control transformers, thermostat and relays. Catalog data shall be marked with red or other contrasting color by arrow, circling, underlining or the equivalent to clearly identify each item and model.

15-1.5.2.2 Shop drawings.-- Submit shop drawings for all equipment and a control wiring diagram showing complete interlock of wiring for input and output control devices, include:

- (a) Relay holding coils;
- (b) Contactors;
- (c) Thermostats;
- (d) Transformers; and
- (e) Switches to point of connection to factory installed wiring integral to air-conditioning system equipment.

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Automatic temperature control equipment installation drawings including wiring diagrams.

15-1.5.2.3 Schedule.- Submit a control device schedule which identifies and completely describes function and operation of each control device.

15-1.5.2.4 Test plan.- Submit a plan describing the system tests proposed for the existing air-conditioning and automatic temperature control systems.

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16-1/01

16-1 ELECTRICAL WORK - GENERAL

16-1.1 General.-

16-1.1.1 Scope.- This section specifies furnishing and installing interior and exterior electrical equipment and materials.

16-1.2 Applicable documents.- The current issues of the following documents in effect on the date of the invitation for bids form a part of this specification and are applicable to the extent specified herein.

16-1.2.1 Federal Specifications (FS).-

J-C-30	Cable and Wire, Electrical (Power, Fixed Installation)
W-B-30	Ballast, Fluorescent Lamp
W-C-375	Circuit Breakers, Molded Case; Branch Circuit and Service
W-C-586	Conduit Outlet Boxes, Bodies, and Entrance Caps, Electrical: Cast Metal.
W-J-800	Junction Box; Extension, Junction Box: Cover, Junction Box (Steel, Cadmium or Zinc - Coated)
W-P-115	Panel, Power Distribution
W-S-610	Splice, Conductor
QQ-W-343	Wire, Electrical (Uninsulated)
WW-C-566	Conduit, Metal, Flexible
W-F-414	Fixture, Lighting (Fluorescent, Alternating Current, Pendant Mounting)

16-1.2.2 Military Specifications.-

MIL-R-21931 Resin, Epoxy

16-1.2.3 National Electrical Manufacturers Association (NEMA).-

OS 1	Sheet Metal Outlet Boxes, Device Boxes, Covers, and Box Supports
MG 1	Motors and Generators

16-1.2.4 National Fire Protection Association (NFPA).-

70 National Electrical Code (NEC)

16-1.2.5 Underwriters Laboratories, Inc. (UL).-

UL 6 Rigid Metal Conduit

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UL 98	Enclosed Switches
UL 514	Outlet Boxes and Fittings
UL 542	Lampholders, Starters, and Starter Holders for Fluorescent Lamps
UL 1242	Intermediate Metal Conduit

16-1.3 Products and materials.-

16-1.3.1 Heavywall steel conduit.- Heavywall zinc coated rigid steel conduit and fittings shall conform to UL 6 and UL 514. Rigid steel conduit may be used in all locations. Coated rigid steel conduit shall be used for installation below slab or grade, or underground. The conduit shall be factory coated with either .008 inch of epoxy resin in accordance with MIL-R-21931, .020 inch of polyvinyl chloride or .063 inch of coal tar enamel or field wrapped with .01 inch thick pipe wrapping plastic tape applied with 50 percent overlap. Fittings for use with rigid steel conduit shall be threaded type and of the same material as the conduit. Where conduits enter boxes or cabinets without threaded hubs, double locknuts shall be used plus a phenolic insulated metallic bushing on the open end.

16-1.3.2 Intermediate steel conduit.- Intermediate zinc coated rigid steel conduit and fittings shall conform to UL 1242 and UL 514, and bear the UL label. Only factory made sweep ells shall be used. Field bends are not acceptable. Fittings shall be threaded type and of the same material as the conduit. Where conduits enter boxes or cabinets without threaded hubs, use double locknuts and phenolic insulated metallic bushing on each open end.

16-1.3.3 Flexible steel conduit.- Flexible steel conduit shall conform to FS WW-C-566. Use in 12 inch nominal lengths for terminal connections to motors or motor driven equipment, and use in short lengths for other applications as permitted by the NEC. Liquid tight flexible conduit shall be used outdoors or in wet locations. A separate ground conductor shall be provided across all flexible connections in addition to the green ground wire.

16-1.3.4 Conductors, uninsulated.- Copper in accordance with FS QQ-W-343.

16-1.3.5 Conductors, insulated.- Unless otherwise indicated, insulated conductors shall be copper with thermoplastic or thermosetting insulation, type THW, THWN, and XHHW for general use, or type THHN for use in dry locations only, all insulated for 600V in accordance with FS J-C-30. Conductors No. 10 AWG and smaller shall be solid, and conductors No. 8 AWG and larger shall be stranded. Use No. 12 AWG (min.) for branch circuit conductors. Use No. 14 (min.) for control wiring.

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16-1.3.6 Wiring, fixture.- Copper, with thermoplastic insulation type TF, TFF, TFN or TFFN insulated for 600 volts, in accordance with FS J-C-30.

16-1.3.7 Boxes.- Boxes shall be either the cast metal hub type conforming to FS W-C-586 or shall be one piece galvanized steel type conforming to FS W-J-800. Where not sized on the drawings, boxes shall be sized in accordance with the NEC. Provide boxes in the wiring or raceway system for pulling wires, making connections, and mounting devices or fixtures. Boxes for metallic raceways shall be of the cast-metal threaded hub type rated for use in wet locations. Boxes in other locations shall be cast metal hub type or one piece galvanized steel with cover designed for surface installation. Each box shall have the volume required by the NEC for the number of conductors in the box. Each outlet box shall have a machine screw which fits into a tapped hole in the box for the ground connection. Boxes for mounting lighting fixtures shall be not less than 4-inches square. Boxes for use in masonry block walls shall be square-cornered tile-type, or standard boxes having square-cornered tile-type covers.

16-1.3.8 Switches, wall.- Wall switches shall be specification grade, rated 120/277 volts, and fully rated 20 amps, AC only. Wiring terminals shall be of the screw type. Switches shall be the quiet operating type, and ivory colored. Not more than one switch shall be installed in a single gang position. Unless indicated otherwise, switches shall be installed 48 inches above finished floor. Wall switches shall bear the UL label.

16-1.3.8.1 Switches, safety.- Safety switches shall conform to UL 98, heavy duty, unless otherwise indicated. Switches mounted in dry locations shall be in NEMA OS1, type 1 enclosures. Switches installed outdoors, or in damp or wet locations shall be mounted in NEMA OS1, Type 3R enclosures. Switches shall be of the voltage and current ratings indicated, and each capable of interrupting the locked rotor current of the motor. The locked rotor current is assumed to be ten times the full rated load current. The switches shall be of the quick-make, quick-break type, parts shall be mounted on insulating bases to permit replacement of part from the front of the switch. Current-carrying parts shall be of high-conductivity copper, designed to carry rated load without excessive heating. Switch contacts shall be silver-tungsten type or plated to prevent corrosion, pitting and oxidation and to ensure suitable conductivity. Safety switches shall be lockable in either position.

16-1.3.9 Photoelectric control.- Unless otherwise indicated, the photoelectric control for exterior entrance lights shall be 120 volt, 3000 watt, single pole, single throw, double break. Mount the photoelectric control in a waterproof watt hour meter socket.

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16-1.3.10 Panelboards.- Panelboards shall conform to FS W-P-115 Type I, Class 1, be UL listed by except for installations which require special panelboards to incorporate items not available as UL listed. All panelboards shall have a piano hinged door in the cover. Doors over 48 inches in height shall have auxiliary fasteners on top and bottom.

16-1.3.10.1 Gutters.- Side wiring gutters shall be 8 inches minimum for mains over 225 amps and up to 600 amps.

16-1.3.10.2 Circuit breakers.- UL listed, Quick-make, quick-break, bolt on, thermomagnetic type, conforming to FS W-C-375. Rate circuit breakers for the voltage of the circuit on which they are used, minimum interrupting rating 22,000 amperes symmetrical for branch breakers, and 30,000 amperes symmetrical for main breakers. Circuit breakers shall have a trip indicating feature. Single pole breakers shall be a full size module, and two and three pole breakers shall be sized in even multiples of a single pole breaker. Size breakers so that two single pole breakers will not be capable of fitting in a single housing. Multipole circuit breakers shall have an internal common trip mechanism. Devices with an adjustable magnetic trip shall be factory set to the low value. Circuit breakers and the panelboards in which the breakers are installed shall be products of the same manufacturer. Self-enclosed circuit breakers shall be mounted in NEMA OS1, type 1 enclosures with trip rating, voltage rating and number of poles as indicated.

16-1.3.10.3 Bus bars.- Buses shall be copper. Bus capacity shall be as indicated. Circuit breaker current-carrying connections to bus shall be bolted type and factory assembled. Stab-in types are not acceptable. Bus bar connections to branch circuit breakers shall be of the sequence phase type. Connect branch circuits to the individual circuit breakers as indicated. The neutral bus shall be insulated from panelboards. Panelboards shall have an uninsulated ground bus bolted to the cabinet, adequate in size to accommodate present and future equipment grounding conductors. Isolate ground bus from the neutral bus except at the service disconnect means. Where provisions for, future breakers are indicated, the panelboard shall be equipped with bus connections for future breaker installation.

16-1.3.11 Motors.- Shall conform to NEMA MG 1 minimum insulation Class B, squirrel-cage type, having normal starting-torque and low-starting-current characteristics. Motors shall be of sufficient size for the duty to be performed, and shall not exceed the full-load rating when the driven equipment is operating at specified capacity. Motors shall be rated for the voltage of the connected system. Unless otherwise indicated, motors shall have open frames, and continuous-duty classifications. The horsepower ratings indicated are for guidance only and do not limit the equipment size.

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Provide each motor with a disconnecting means and a manually operable switch as indicated or when required by the NEC. For single-phase motors, a single or double-pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Enclose safety switches as specified. Switches shall disconnect all ungrounded conductors.

16-1.3.12 Fuses.— Fuses shall have a voltage rating not less than the circuit voltage. Cartridge fuses shall have an interrupting rating as indicated, but if not indicated shall be not less than 100,000 amps when used in branch and distribution circuits, and not less than 200,000 amps when used in a service entrance switch.

16-1.3.13 Lighting fixtures.—

16-1.3.13.1 General.— Lamps and lighting fixtures shall be of the types indicated, UL approved and bear the UL label. Incandescent lamps shall be rated for 120 volts.

16-1.3.13.2 Fluorescent fixtures.— Fixture lenses shall be the prismatic type, made of virgin acrylic. Lamps shall be rapid start, cool white. Ballasts shall be class P, rapid start, high power factor type conforming to FS W-B-30. Provide ballasts with choke type radio frequency interference suppressors. Ballasts shall bear the CBM/ETL label. Lampholders shall have silver plated contacts, and conform to UL 542. Pendant mounted fixtures shall conform to FS W-F-414 and of the types indicated. Single-unit suspended fluorescent fixtures shall have twin-stem hangers. Multiple-unit or continuous row fluorescent units shall have a tubing or stem for wiring at one point, and a tubing or stem suspension provided for each unit length of chassis including one at each end.

16-1.3.13.3 Incandescent fixtures.— Incandescent fixtures shall be provided for exterior lighting, type as indicated. Fixtures shall bear the U.L. label.

16-1.3.14 Surge arrestor (FAA furnished).— 120/208V, 3-phase, 4-wire.

16-1.3.15 Splices.— Solderless connectors for splices shall conform to FS W-S-610.

16-1.4 Installation.—

16-1.4.1 Wiring.—

16-1.4.1.1 General.— In the three phase system specified, not more than one wire from each of the three phases shall be run with a common neutral. Neutral conductors shall extend from the neutral bus in the device where the active conductors originate. Device terminals for connection of more than one conductor shall be specifically designed for the purpose.

16-1.4.1.2 Raceways.-- Minimum conduit size shall be 3/4-inch, 1/2 inch is acceptable for exposed control wiring conduit. Each run shall be complete, fished, and swabbed before conductors are installed. Cap ends of conduit systems not terminated in boxes or cabinets. Exposed raceways shall be installed parallel to or at right angles with the lines of the structure. A pull wire shall be installed in empty tubing and conduit systems. The pull wire shall be No. 14 AWG zinc coated steel, or plastic with a minimum 200 pound tensile strength. Ten inches of slack shall be left at each end of the pull wire. Sections of raceways which pass through damp, concealed or underground locations shall be of the type specified for such locations, and extending a minimum of 12 inches beyond the damp, concealed, or underground area.

Where conduit has to be cut in the field, cut square using a hand or power hacksaw or approved pipe cutter using cutting knives. The cut ends of the field-cut conduit shall be reamed to remove burrs and sharp edges. Where threads have to be cut on conduit, the threads shall have the same effective length and the same thread dimensions and taper as specified for factory cut threads on conduit.

Use rigid galvanized steel or intermediate metal conduit throughout the project except where flexible metal conduit is required for vibration, or where otherwise indicated. EMT is not acceptable.

16-1.4.1.2.1 Raceway support systems.-- Raceways shall be securely supported and fastened in place at intervals of not more than 10 feet and within 3-feet of each outlet box, junction box, cabinet or fitting, with pipe straps, wall brackets, hangers, or ceiling trapeze. Fastenings shall be by wood screws, nails or screw-type nails to wood; by toggle bolts to hollow masonry units; by expansion-bolts to concrete; by machine screws, welded threaded studs, or spring tension clamps to steel work. Nail type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts or machine or wood screws.

Threaded C clamps with retainer may be used. Raceways or pipe straps shall not be welded to steel structures. Holes cut to a depth of more than 1-1/2 inches in reinforced concrete beams shall not cut the main reinforcing bars. Holes not used shall be filled. In partitions of light steel construction, sheet metal screws may be used. Raceways shall not be supported from sheet metal roof decks.

16-1.4.2 Boxes.-- Cast-metal boxes installed in wet location and boxes installed flush with the outside of exterior surfaces shall be gasketed. Separate boxes shall be provided for flush or recessed fixtures where required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes. Boxes shall not be supported from sheet metal roof decks. Boxes and supports shall be fastened to wood with wood screws, nails, or screw-type nails of equal holding strength; with bolts and expansion shields to masonry and with

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machine screws or welded studs to steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts, or nail-type nylon anchors may be used instead of expansion shields, or machine screws. In open overhead spaces, cast metal boxes threaded to raceways shall not be separately supported except where used for fixture support; cast metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved type fastener not more than 24 inches from the box. Penetration shall be no more than 1-1/2 inches into reinforced-concrete beams.

16-1.4.3 Splicing.-- Splices shall be made only at outlets, junction boxes, or accessible raceways. Use wire nuts to splice conductors sized No. 10 AWG and smaller, and compression connectors to splice conductors No. 8 AWG and larger. Splices shall be taped with electrical insulating tape in a manner which makes their insulation equal to the insulation on the conductors.

16-1.4.4 Device plates.-- Plates of the one piece type shall be provided for all outlets and fittings to suit the devices installed. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plates shall be installed with an alignment tolerance of 1/16 inch.

16-1.4.5 Photoelectric control.-- Install on the building exterior, faced in a northerly direction.

16-1.4.6 Panelboards.-- Panelboards shall be mounted so that the height to the top of the panelboard is 6 feet and 9 inches above the finished floor level. Directories shall be typed to indicate the load served by each circuit, mount in a holder with protective covering. Arrange the directory so that the typed entries simulate the circuit breaker positions in the panelboard.

16-1.4.7 Fuses.-- A complete set of fuses shall be installed and one set of spares shall be furnished for each fusible device. Time/current tripping characteristics of fuses serving motors or connected in series with circuit breakers shall be coordinated for the proper operation.

16-1.4.8 Grounding.--

16-1.4.8.1 General.-- Grounding system connections shall be made as indicated on the drawings and in accordance with the NEC.

16-1.4.8.2 Equipment grounding.-- All electrical equipment, including light fixtures and receptacles shall be grounded by means of a separate green insulated ground wire minimum of No. 12 AWG, routed within the raceway. The ground conductor shall be connected to the power panel or lighting panel equipment ground bus. All metallic non-current carrying parts of electronic equipment shall be grounded to the grounding system.

16-1.4.8.3 Protection.-- Mechanical protection shall be provided for all cables in the ground system where they may be subject to damage. Protection shall be provided by conduit, floor trenches, routing behind permanent structural members, or other acceptable means. Where routed through metal conduit, bond conduit to the cable at each end.

16-1.4.8.4 Raceway ground.-- Every component of metallic conduit runs such as individual sections, couplings, line fittings, pull boxes, junction boxes, and outlet boxes shall be bonded to the ground system. Conduit brackets and hangers shall be securely bonded to the conduit and to the metal structure to which they are attached. Wireways shall be bonded at each joint with a No. 6 AWG ground conductor.

16-1.4.8.5 Electronic ground conductor.-- Electronic ground system is indicated on drawings. Ground conductor shall be separate from equipment ground conductor, color shall be green with yellow tracer. Connections of electronic equipment to the electronic ground are NIC.

16-1.4.9 Identification.--

16-1.4.9.1 Nameplates.-- Each of the following types of equipment shall be identified with a name plate showing the functional name of the unit, voltage utilized, one or three phase as applicable, and any other pertinent information. Switches for local lighting are not required to be identified.

Motor controllers
Panel boards
Switches
Self-enclosed circuit breakers

Other electrical equipment shall be identified if requested by the COR. Name plates shall be non-ferrous metal or rigid plastic, stamped, embossed or engraved with 3/8 inch minimum height lettering or numerals. The plates shall be secured to the equipment with a minimum of two screws.

16-1.4.9.2 Color coding.-- Branch circuit and feeder conductors shall be color coded. The color coding shall be continuous throughout the facility on each phase conductor to its point of utilization so that the conductor phase connection is readily identifiable in any part of the installation. The equipment grounding conductor shall be as specified. Neutral conductors shall be continuous white. The neutral of the other systems shall be white with identifiable colored tracers (not green). Where color coding is not available in the larger size conductors, the conductors shall be color coded by use of color coded tape, half lapped for a minimum length of 3 inches. Where conductors are color coded in this manner, they shall be color coded in junction and pull boxes, accessible raceways, panelboards, outlets and switches, as well as at terminations. Conductors in accessible raceways shall be coded in such manner that by removing or opening the cover, the coding is visible.

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Phase conductors shall be color coded as follows:

Three Phase

120/208 or 240 Volts

Phase A - Black

Phase B - Red

Phase C - Blue

16-1.4.9.3 Conductor markers.- In addition to color coding, all line, phase, and neutral conductors shall be identified by plastic-coated, self-sticking, printed markers or permanently attached stamped metal foil markers. Panel and circuit numbers shall be identified. Conductor identification shall be provided at terminations, and in junction boxes through which the conductors pass. Control circuit conductor identification shall be made by heat shrink tubing or permanently attached stamped metal foil markers. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved shop drawings. Hand lettering or marking is not acceptable.

16-1.4.10 Cutting and patching.- Electrical work shall be carefully laid out in advance to avoid damaging work-in-place or concealed work. Take the necessary precautions when cutting, channeling, chasing, or drilling the floors, walls, partitions, ceilings, or other surfaces. Damage to the building, utilities and equipment shall be repaired or replaced by skilled mechanics of the trades involved at no additional cost to the FAA.

16-1.5 Quality assurance.-

16-1.5.1 Submittals.- Conform to the procedures specified.

16-1.5.1.1 List of materials and equipment.- Submit complete list of materials and equipment. List shall include manufacturer's style or catalog numbers. Catalog cuts or other descriptive data shall be furnished if required by the COR. Partial lists submitted from time to time are not acceptable.

16-1.5.1.2 Shop drawings.- Shop drawings shall be submitted for materials and equipment not completely identifiable by information submitted in the materials and equipment lists.

16-1.5.2 Tests.-

16-1.5.2.1 General.- Perform the following tests and submit test results.

16-1.5.2.2 Load balancing.-- After the electrical installation has been completed, take current readings with a clamp-on ammeter on each phase of the feeders to each panelboard, and on the main service conductors. Redistribute the loads where greater than a 20 percent difference between readings in any two phases. If any phase is loaded above 80 percent of the rating of its over-current protective device, and corrective action cannot be taken, notify the COR.

16-1.5.2.3 Insulation resistance.-- Feeders and branch circuits shall have their insulation tested after installation, but before connection to fixtures or equipment. Motors shall be tested for grounds or short circuits after installation but before start-up. Conductors shall be free from short circuits and grounds, and a minimum insulation resistance phase-to-phase and phase-to-ground shall be 10 megohms measured with a 500 volt insulation resistance tester.

16-1.5.2.4 Neutral isolation.-- After installation of branch circuits, the neutral in the service entrance switch shall be tested for isolation from ground with an ohmmeter set on its RX1 scale. The incoming neutral shall be temporarily disconnected to accomplish this test. Contact between the neutral and ground, other than at the service entrance switch, is a possible cause of noise in electronic equipment and shall be corrected.

16-1.5.2.5 Operating.-- After the interior wiring system installation is completed, and at such time as the COR directs, conduct an operating test. The test shall demonstrate that the equipment is operating in accordance with the specified requirements.

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16-3 POWER SYSTEM SWITCHOVER

16-3.1 General.-

16-3.1.1 Scope.- Provide proper work sequencing in order to minimize power system interruption and the resultant effect on the operational radar. The power system transition sequence specified below in conjunction with the one line diagram shown on the drawing is provided as general guidance for the power system switchover. Submit a planned work sequence which includes specific system interruptions.

16-3.1.2 Notification.- Notify the COR four working days prior to interrupting the power systems to ensure scheduling during periods of low aircraft operational activity.

16-3.1.3 Sequence.-

16-3.1.3.1 Installation of new electrical equipment.-

- (a) Install new electrical panel EPA and the feeder from the existing by-pass switch. Do not connect the feeder at either end.
- (b) Install branch circuits to the new and the reconnected equipment except for the service to Panel A and Panel C.
- (c) Install temporary power service to the new Panel EPA for testing the new equipment.
- (d) Install temporary standby diesel generator, 50 kw minimum.
- (e) Serve all new loads from the new power Panel EPA with temporary diesel generator as a source of power supply. Panel A and branch circuits will be served from the existing power supply with backup from the existing engine/generator.

16-3.1.3.2 Switching of facility over to new power service.-

- (a) Deenergize service to Panel A, open existing 400 ampere service entrance switch. Disconnect and remove the feeder to Panel A from bypass switch.
- (b) Connect service from bypass switch to Panel EPA.
- (c) Deenergize temporary engine generator service to Panel EPA and energize utility service, close existing 400 ampere service entrance switch.
- (d) Connect Panel A and Panel C service to Panel EPA.
- (e) Facility is now served from the new Panel EPA.
- (f) Remove temporary diesel generator.

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16-3.2 Applicable documents.-- Not used.

16-3.3 Materials.-- Not used.

16-3.4 Installation.-- Not used.

16-3.5 Quality assurance.--

16-3.5.1 Submittals.-- Conform to the procedures specified.

16-3.5.1.1 Transition plan.-- Submit a transition plan formulated to minimize power interruptions to the radar and HVAC equipment, include a step-by-step detailed procedure with estimated time intervals between steps.

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